due January 6^{th} (Monday)

5.2/ 49-50, 53-54, 57, 62-63, 67

5.3/ 51, 53-55, 59-61, 64, 68-69

5.4/ 16-17, 51-52, 55-57, 61-62, 69-70, 76-77, 81-82, 85, 114

5.5/ 21-26, 31, 34-37, 41, 50, 59, 62

5.6/ 1-75

day 72

Extra Credit

Barrons chapter 3 problems at end

Dec 18-7:20 AM

5.6/ Integration using Substitution

day 72

Moving Beyond the Rules

Every derivative rule is an "integration rule" in reverse

Often this isn't much help ☹

But notice: $\frac{d}{dx}\left(f(g(x))\right) = f'(g(x))\cdot g'(x)$

Lurking bts integration rule:

$$\int \underbrace{f'(g(x))}\cdot\underbrace{g'(x)}\,dx = f(g(x))+C$$

Dec 18-7:20 AM

day 72

5.6/13

$$\int \boxed{2x}\,(x^2+1)^4\,\boxed{dx}$$

idea

Let $g'(x)=2x$

$g(x)=x^2+1$ in this case

Let $u=x^2+1$

then $du=\boxed{2x\,dx}$

or $\frac{du}{dx}=2x$ so $du=2x\,dx$

$$\int 2x(x^2+1)^4\,dx$$
$$=\int (\sim)^4\,d\sim$$
$$=\frac{(\sim)^5}{5}+C$$
$$=\frac{(x^2+1)^5}{5}+C$$

$$\int u^4\,du=\frac{u^5}{5}+C$$
$$=\frac{(x^2+1)^5}{5}+C$$

5.6/17

day 72

$$\int \boxed{2x}(x^2-1)^{99}\,\boxed{dx}$$

replace as many as needed

Let $u = x^2-1$

then $du = \boxed{2x\,dx}$

replace 1st

$$\int u^{99}\,du$$

$$= \frac{u^{100}}{100} + C$$

$$= \frac{(x^2-1)^{100}}{100} + C$$

Dec 18-7:20 AM

18)

day 72

$$\int \boxed{x} e^{x^2} \boxed{dx}$$

$$\int e^u du = e^u + C$$

Let $u = x^2$

then $du = 2x\,dx$

$\frac{du}{2} = \frac{2x\,dx}{2}$

$\frac{1}{2} du = \boxed{x\,dx}$

$$\frac{1}{2}\int e^u du$$

$$= \frac{1}{2} e^u + C$$

$$= \frac{1}{2} e^{x^2} + C$$

Guide

Looking for one of the 14

day 72

19) $\int \frac{2x^2}{\sqrt{1-4x^3}}\,dx$

$\int \frac{1}{\sqrt{1-?^2}}$

or

$\int \frac{1}{\sqrt{\ }}$ $(\ )^{-\frac{1}{2}}$

Let $u = 1-4x^3$

$du = -12x^2\,dx$

$\frac{du}{-6} = \frac{-12}{-6}x^2\,dx$

$-\frac{1}{6}du = \boxed{2x^2\,dx}$

$\left(-\frac{1}{6}\right)\int \frac{1}{\sqrt{u}}\,du$

$= -\frac{1}{6}\int u^{-\frac{1}{2}}\,du$

$= -\frac{1}{6}\,\frac{u^{1/2}}{1/2} + C$

$= -\frac{2}{6}\sqrt{u} + C$

$= -\frac{1}{3}\sqrt{1-4x^3} + C$

Dec 18-7:20 AM

day 72

24) $\int \sin^{10}\theta \boxed{\cos\theta \, d\theta}$

$\int u^{10} du$

$= \frac{u^{11}}{11} + C$

Let $u = \sin\theta$

$du = \boxed{\cos\theta \, d\theta}$

[remember – $\sin^{10}\theta = (\sin\theta)^{10}$]

$\frac{\sin^{11}\theta}{11} + C$

Dec 18-7:20 AM

unnumbered

day 72

$$\int \frac{\boxed{\cos x}}{1+\sin^2 x}\boxed{dx}$$

Let $u = \sin x$

$du = \boxed{\cos x\, dx}$

$$\int \frac{1}{1+u^2}\, du$$

$$= \tan^{-1}(u) + C$$

$$\tan^{-1}(\sin x) + C$$

Dec 18-7:20 AM

day 72

creative technique

1) Decide on a u-substitution
(u= inside f^n)

2) Take the derivative of both sides
(differential form)

$2\frac{1}{2}$) build integral in "u"

3) if you have a basic rule, take antiderivative
if not, repeat 1-2 or try different u=

* consider
→ inside f^n and derivative of inside f^n
→ where you are headed
(big 14)

Dec 18-7:20 AM